

## UNITED STATES PATENT OFFICE.

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## PROPELLANT POWDER AND PROCESS OF MAKING THE SAME.

No Drawing. Original application filed June 20, 1924, Serial No. 721,203. Divided and this application filed October 12, 1925. Serial No. 62,091.

This invention relates to progressive powders and more particularly to progressive burning propellant powders adapted for use in small arms such as shot guns. This application is a division of my application Serial Number 721,203, filed June 20, 1924.

The rate of burning of a powder is dependent upon its composition. Thus dense colloided nitro-cellulose powder has a lower rate of burning than, for instance, a low nitration nitro-cellulose bulk powder or a nitro-glycerin-nitro-cellulose powder.

One of the objects of this invention, therefore, is to provide a progressive burning powder consisting of blended grains, the compositions of which are so chosen as to cause a blended charge thereof to burn progressively.

Another object of this invention is to provide a progressive burning powder, consisting of blended portions, each portion having a grain size and composition which is different from that of the other, the characteristics of the several portions being so chosen as to cause a blended charge thereof to burn progressively.

Another object is to provide such a progressive burning powder which is particularly adapted for use as the propellant charge in a shot shell.

Further objects will appear from the detail description in which will be disclosed a number of illustrative embodiments of this invention.

In accordance with this invention a powder is produced by selecting powder portions so that the grains of the several portions burn at progressively decreasing rates and the portions so chosen are then blended in the desired proportions so as to produce the desired progressive burning of a blended charge. While the grain compositions of the same portion may be substantially the same, the grain compositions of the several portions vary progressively in accordance with the desired progressive action of a blended charge.

In accordance with an embodiment of this invention, the rate of burning is controlled by proper selection of the grain composition.

Thus a powder adapted for use in shot gun shells containing heavy shot, such as buck shot, is as follows:

80% dense colloided nitro-cellulose powder of high nitration and coated with dinitro-toluene.  
20% nitro-cellulose-nitro-glycerin powder of low nitration and uncoated.

Such a powder has given satisfactory results in high velocity buckshot loads.

An example of controlling the rate of burning by varying both the grain sizes and composition is as follows:

90%-80% ground smokeless powder (dense colloided nitro-cellulose, either coated with dinitro-toluene or uncoated) sized as follows:  
60% through 40 mesh on 46.  
33% through 46 mesh on 70.  
10%-20% black powder—3 F. G.

Another example of mixed grain, size and composition is as follows:

90%-80% ground smokeless—same as the preceding example.  
10%-20% powder consisting of  
70% potassium nitrate  
15% barium nitrate  
15% charcoal.

The charcoal (or cellulose) may be impregnated with the potassium nitrate (or sodium nitrate) and the barium nitrate by a soaking and drying process. The above powder in a standard shot shell load gives 1037 foot seconds with 7346 per square inch as against 985 foot seconds with equal pressure when using standard load of dense smokeless powder.

In accordance with this invention, therefore, the progressive burning action is produced by proper selection of the grain compositions of the portions of the blended charge; and by the proper selection of the proportions of the charge portions the desired progressive burning can be obtained. In accordance with this invention the more rapid burning powders impart their energy directly to the slower burning constituents of the mixture and there is no localizing of pressure but rather a uniform increase in the rate of burning which in turn imparts a sustained drive to the projectile.

In accordance with one embodiment of this invention, the progressive burning action produced by the proper selection of both grain size and composition and by the

proper selection of the portions of the charge, the desired progressive burning can be obtained.

The progressive burning powder made in accordance with this invention is especially suitable for use in shot shells and such a shell may be constructed and loaded as disclosed in application Serial Number 704,124, filed April 4, 1924. In a shell using heavy wadding, and upon firing of the charge, the more readily ignitable powders will keep up the pressures and temperatures necessary to secure the desired progressive burning of the blended charge, while the heavy wadding serves to confine the blended charge. Accordingly the rate of combustion will increase so that the desired pressure is maintained, especially since the heavy wadding provides sufficient resistance to the expansion of the gases to maintain the pressure. The result is, therefore, that the combustion is uniformly accelerated, even after the confining wadding and the shot begin to move, so that the pressure is maintained nearly uniform for an extended distance along the gun barrel; the result is that the shot charge is uniformly accelerated under a lower initial pressure maintained for an extended distance along the gun barrel.

While in the specification and claims the term "grain" is used, it is to be understood that it is intended as a word of general description and not of limitation, but to include the various forms in which powder is produced for use. It will be further understood that while theories of formation and operation have been advanced, the invention is not necessarily limited thereto. It will further be obvious that various changes may be made in details without departing from the spirit of this invention; it is, therefore, to be understood that this invention is not to be limited to the specific details described.

Having thus described the invention, what is claimed is:

1. A progressive burning powder consisting of blended grains, the compositions of which are so chosen as to cause a blended charge thereof to burn progressively.

2. A progressive burning powder consisting of blended portions, the grain composition of each portion being different from that of the other, the compositions of the several portions being so chosen as to cause a blended charge thereof to burn progressively.

3. A progressive burning powder consisting of blended portions, the grain compositions of each portion being substantially the same but the grain compositions of the several portions being so chosen as to cause a blended charge thereof to burn progressively.

4. A progressive powder consisting of blended grains of different compositions, the grain compositions being so chosen as to cause a blended charge thereof to burn progressively.

5. A progressive burning powder consisting of blended portions, each portion having a grain size and composition which is different from that of the other, the characteristics of the several portions being so chosen as to cause a blended charge thereof to burn progressively.

6. The process of making progressive burning powder consisting of blending powder portions in which the grain composition of each portion is different from that of the other and so choosing the grain compositions of the several portions as to cause a blended charge thereof to burn progressively.

7. The process of making progressive burning powder consisting in blending portions in which the grain composition of each portion is different from that of the other and so choosing the compositions of the several portions and the relative proportions of these portions as to cause a blended charge thereof to burn progressively.

8. The process of making progressive powder consisting in selecting powder portions so that the grains of the several portions are of progressively different compositions and blending the portions.

In testimony whereof I affix my signature this 25th day of August, 1925:

ARTHUR S. O'NEIL.